(19) JAPAN PATENT BUREAU (JP)

(11) Publication No.: 2001-336606
(P2001-336606A)

(12) OFFICIAL GAZETTE LAID-OPEN PATENT (A)

(43) Date of laying open: 12/7/2001

(51) Int. Cl.[7]:	ID Code:	FI:		Theme code (ref.):	
F 16 H 48/08		F16C	25/08	Z	3 J 0 1 2
F 16 C 25/08			33/58		3 J 0 2 7
33/58		F16H	57/02	5 3 1	3 J 0 6 3
F 16 H 57/02	5 3 1		57/12	Z	3 J 1 0 1
57/12			1/40		

Request for exam: None No. of Claims: 2 OL (Total of 5 pages)

(21) Application No.: 2000-155814
(P2000-155814)

(22) Date of Application: 5/26/2000

(71) Applicant:
000001247
KOYO SEIKO K.K.
5-8, 3-Chome, Minami-Funaba, Chuo-ku,
Osaka-shi, Osaka-fu

(72) Inventor:
K. YOKOTA
c/o Koyo Seiko K.K.
5-8, 3-Chome, Minami-Funaba, Chuo-ku,
Osaka-shi, Osaka-fu
100090608

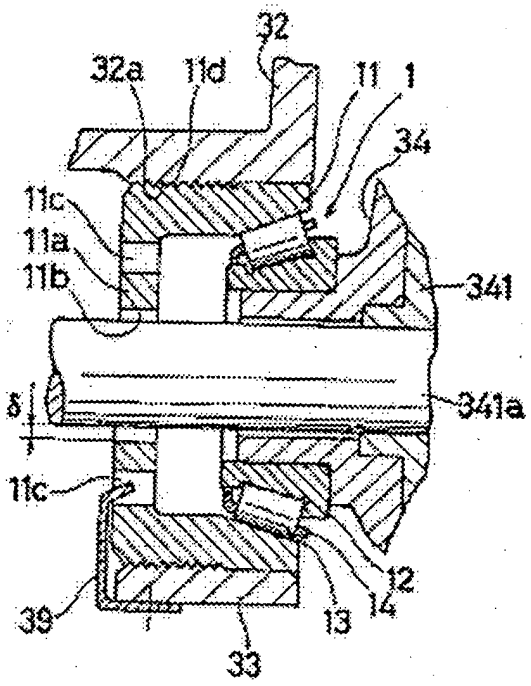
(74) Agent:
M. KAWASAKI, Patent Agent

(54) Title: DIFFERENTIAL DEVICE

(57) Abstract:

Issue: To offer a differential device that can improve the efficiency of backlash adjustment and the side bearing preload adjustment process and improve accuracy.

Solution means: Outer ring 11 of side bearing 1 and the adjusting nut that adjusts the axial position of the side bearing are integrated and side bearing 1 is adjusted in its axial position by rotating the said integrated structure. Thereby, an increase of the adjusting time, due to generation of the initial clearance between both of these members and the occurrence of defective initial seating of outer ring 11, are prevented.



PATENT CLAIMS

Claim 1:

For the differential device, in which the differential gear case that transmits rotation of the drive pinion via the ring gear is rotatably supported via the side bearing, in a space surrounded by a gear carrier and a gear carrier cap, and the axial position of the side bearing in the said space is adjusted by an adjusting nut which is screwed in the said gear carrier and the gear carrier cap, and which acts as a rotation stopper,

a differential device in which the outer ring of the side bearing and an adjusting nut are integrated.

Claim 2:

Differential device of Claim 1, in which the outer ring of the side bearing and an adjusting nut are integrated by the same member.

DETAILED EXPLANATION

[0001]

Technical area of the invention:

This invention relates to a differential device used for the automotive drive system, etc.

[0002]

Conventional technology:

In general, as shown in cross-section in Figure 3, differential case 34 is supported rotatably in the space surrounded by gear carrier 32 and gear carrier cap 33 that are fixed to axle housing 31. Differential case 34 has side gear 341 and pinion gear 342, and pinion shaft 341a in it, and side gear 341 is spline-fitted to axle shaft 342a, and differential case 34 is fixed to ring gear 36, which is engaged with drive pinion 35 and its both ends are supported by side bearing 37 in the said space.

[0003]

Positioning of ring gear 36 with respect to drive pinion 35 (backlash adjustment) and preload adjustment of the side bearing 37 are carried out by regulating the rotary position of adjusting nut 38 by use of rotation stopper 39 while the axial position of outer ring 371 of side bearing 37 is adjusted by turning the adjusting nut 38 that is screwed in gear carrier 32 and gear carrier cap 33.

[0004]

Problem to be solved:

In such a conventional differential device, if the initial axial clearance between adjusting nut 38 and outer ring 371 of side bearing 37 is large, adjusting nut 38 needs to be rotated multiple times for adjustment during the assembly process and this work takes time. Furthermore, accuracy can be degraded because of defective initial seating of the bearing, since outer ring 371 does not rotate, even when adjusting nut 38 is tightened. In addition, the number of components is high and the construction is complex, so that automation of the assembly work is difficult.

[0005]

This invention eliminates such problems altogether and it offers a differential device which improves the efficiency of adjustments of backlash and bearing preload and accuracy.

[0006]

Means of solving the problem:

To achieve this objective, in the differential device of this invention, for a differential device in which the differential gear case that transmits rotation of the drive pinion via the ring gear is rotatably supported via the side bearing, in a space surrounded by a gear carrier and a gear carrier cap, and the axial position of the side bearing in the said space is adjusted by an adjusting nut which is screwed in the said gear carrier and the gear carrier cap, and which acts as a rotation stopper,

a differential device in which the outer ring of the side bearing and an adjusting nut are integrated.

[0007]

Integral construction of the outer ring of the side bearing and the adjusting nut by using a same member (Claim 2) is suitable for this invention.

[0008]

In this invention, the adjusting nut and outer ring of the side bearing are not separate units and the outer ring is moved indirectly by tightening the adjusting nut, as in the conventional case, but the set objective is realized by integration of the two components.

[0009]

Integration of the adjusting nut and bearing outer ring prevents generation of axial clearance between the two components and prevents increasing of adjustment work due to such clearance. At the same time, integration of the bearing outer ring and adjusting nut prevents defective initial seating of the bearing outer ring due to rotation of the adjusting nut. In addition, integration of the two components reduces the number of components to be assembled and adjusted, allowing easier automation of assembly work.

[0010]

When the side bearing outer ring and the adjusting nut are integrated into a unit member, as in Claim 2, the number of components and manufacturing cost are reduced.

[0011]

Practical Example:

A practical example of this invention is explained below with the aid of figures. Figure 1 is a cross-section of the proximity of one of the side bearings of the practical example of this invention.

[0012]

In this example, the basic structure of the differential device is the same as the conventional one in Figure 3; the same codes are assigned to the same members in Figure 1 as in Figure 3 and the members not shown in Figure 1 are identified by use of the codes in Figure 3.

[0013]

An adjusting nut to adjust the axial position of side bearing 1, which supports both ends of differential case 34, is the characteristic of this practical example.

[0014]

That is, in this example, among outer ring 11, inner ring 12, tapered roller 13 and retainer 14 of side bearing 1, inner ring 12, tapered roller 13 and retainer 14 are the same as those of a normal tapered roller bearing, but outer ring 11 is close to a cup shape as a whole, and through-hole 11b, for pass-through of axle shaft 341a with a set clearance, is formed at its bottom 11a and multiple positioning holes 11c are provided around hole 11b at a set pitch.

[0015]

Male thread 11d is formed on the outer periphery of outer ring 11 of side bearing 1 and the male thread 11d is engaged with female thread 32a, formed in gear carrier 32 and gear carrier cap 33. The axial position of outer ring 11 is determined by the position of said thread engagement. Rotation stopper 39, which can be inserted in either one of positioning holes 11c of outer ring 11, is attached by screwing to gear carrier cap 33. Incidentally, this construction is the same for both left hand and right hand side bearings 1.

[0016]

In the above example, side bearing 1 is moved in the axial direction by turning outer ring 11 of side bearing 1 and the axial position of side bearing 1 can be fixed by inserting rotation stopper 39 in positioning hole 11c at a set rotary position. Therefore, outer ring 11 of side bearing 1 acts also as an adjusting nut for adjustment of the axial position of side bearing 1 and the number of components is reduced by that much. At the same time, defective initial seating of outer ring 11 is prevented. In addition, adjustment of the axial position of side bearing 1 is by the rotation of outer ring 11 itself, so the increased amount of adjustment work caused by the initial axial clearance between the adjusting nut and the outer ring, as in the conventional case, is prevented. Outer ring 11 can also act as a buffer plate to prevent leakage of oil in gear carrier 32 to the wheel side when the clearance δ between through-hole 11b of outer ring 11 and side gear shaft 342a is optimized.

[0017]

The above practical example has bearing outer ring 11 with the function of the adjusting nut. In other words, the adjusting nut and the outer ring are integrated from the same member but this invention is not limited to that and, as shown below, the outer ring and adjusting nut can be separate members, which are integrated afterward.

[0018]

Figure 2 is a cross-section of such an example. In this example, outer ring 11' of side bearing 1 is the same as that of a normal tapered roller bearing and the outer ring 11' is attached to adjusting nut 2, in advance. In this example, adjusting nut 2 is cup-shaped; through-hole 2b, to insert axle shaft 341a with a set clearance δ, is formed in its bottom part 2a, while positioning hole 2c is formed around it and male thread 2d is formed on its periphery. Outer ring 11' is fitted by pressing to a larger diameter 2e on the inner periphery of adjusting nut 2 to integrate with adjusting nut 2. Under such integration conditions, its entirety is of the same shape as outer ring 11 in the example in Figure 1. In this example too, outer ring 11' and adjusting nut 2 are integrated in advance at the time of shipment from the bearing manufacturer, etc., so that outer ring 11' rotates integrally with adjusting nut 2 to exhibit the same function as the example in Figure 1.

[0019]

Effect:

As explained above, the adjusting nut and outer ring of the side bearing are integrated for adjustment of the backlash between the ring gear and drive pinion, adjustment of the preload of the side bearing and adjustment of the axial position of the side bearing in this invention, so that, compared to a conventional differential device, in which the bearing outer ring is pressed by rotating a separate adjusting nut for position adjustment efficiency of assembly, backlash and preload adjustment is improved and the accuracy of the work can be stabilized, because defective initial seating of the bearing outer ring is prevented. In addition, the number of components of the device is reduced for easier assembly automation.

Brief explanation of the figures:

Figure 1 is a cross-section of a practical example of this invention.

Figure 2 is a cross-section of another practical example of this invention.

Figure 3 is a cross-section of a conventional differential device.

Explanation of the codes:

1 - side bearing

11, 11' - outer ring

11a - bottom part

11b - through-hole

11c - positioning hole

11d - male thread

12 - inner ring

13 - tapered roller

14 - retainer

2 - adjusting nut

2a - bottom part

2b - through-hole

2c - positioning hole

2d - male thread

2e - large diameter

39 - rotation stopper

Figure 1

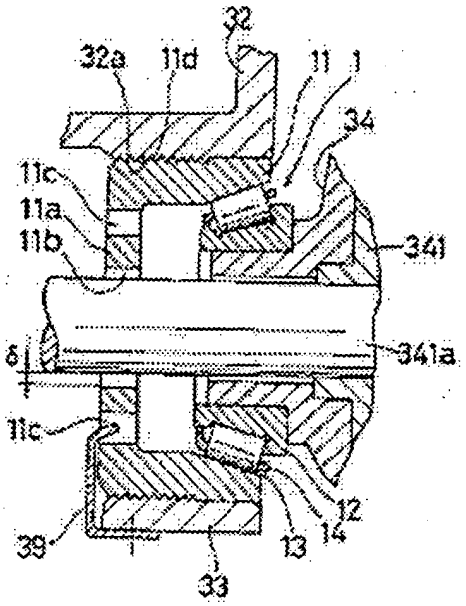


Figure 2

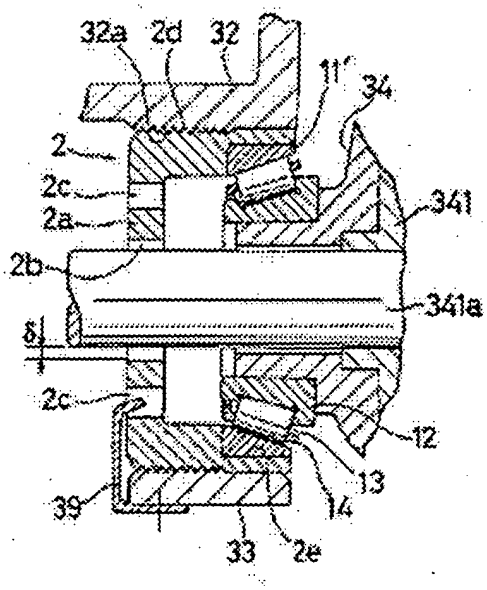
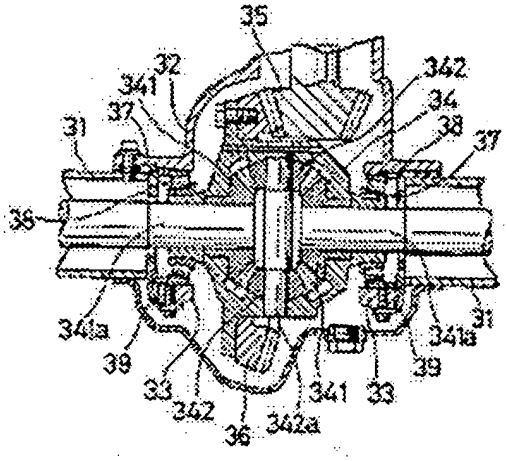


Figure 3



Continuation from the front page:

F-theme (ref): 3J012 AB04 BB03 CB01 FB12
3J027 FA18 FA19 FB02 HB07 HC07
HC11 HC19
3J063 AA02 AC11 BA01 BB19 BB23
BB27 BB46 CA05 CD03 CD53
XA03 XA11
BJ101 AA16 AA25 AA32 AA42 AA54
AA62 BA54 BA56 BA77 FA41
FA46 FA48 GA01

Title: JP2001336606A2: DIFFERENTIAL DEVICE
Country:
Kind: JP Japan
A2 Document Laid open to Public Inspection 1
Inventor: YOKOTA KUNIHIKO;
Assignee: KOYO SEIKO CO LTD
Published / Filed: 2001-12-07 / 2000-05-26
Application Number: JP2000000155814
IPC Code: F16H 48/08; F16C 25/08; F16C 33/58; F16H 57/02; F16H 57/12;
Priority Number: 2000-05-26 JP2000000155814
Abstract: PROBLEM TO BE SOLVED: To provide a differential device capable of adjusting a backlash, capable of improving efficiency of a preload adjusting process of a side bearing and capable of improving accuracy.
SOLUTION: An outer race 11 of the side bearing 1 and an adjusting nut for adjusting a shaft directional position of the side bearing are integrated, and are constituted so as to adjust the shaft directional position of the side bearing 1 by a rotational movement of the integrated structure, and an increase in adjusting time by generation of initial clearance between both of these members and the occurrence of initial seating failure of the outer race 11 are prevented.
COPYRIGHT: (C)2001,JPO